

Claims

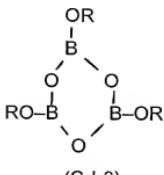
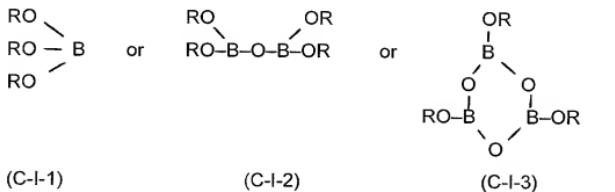
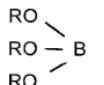
1. A lubricating oil composition, comprising:

(A) a base oil;

5 (B) a molybdenum and sulfur containing composition derived from a basic nitrogen containing compound, a molybdenum compound and carbon disulfide;

(C) a boron-containing compound selected from the group consisting of:

(C-I) a borated ester represented by one or more of the formulae



(C-I-1)

(C-I-2)

(C-I-3)

10 wherein in formulae (C-I-1), (C-I-2) and (C-I-3), each R is independently a hydrocarbon group and any two adjacent R groups may together form a cyclic group;

15 (C-II) at least one borated epoxide comprising the product made by reacting a boron reactant with one or more epoxides represented by the formula



20 wherein in formula (C-II-1) each R is independently hydrogen or a hydrocarbon group and any two adjacent R groups may together form a cyclic group, with the proviso that when a single epoxide is used the total number of carbon atoms in the R groups does not exceed about 12, and when a mixture of epoxides is used the

average on a mole basis for the total number of carbon atoms in the R groups for the mixture does not exceed about 12; and

(C-III) mixture of (C-I) and (C-II); and

5 (D) optionally a phosphorus containing compound, provided the phosphorus content of the lubricating oil composition does not exceed about 0.10% by weight.

2. The composition of claim 1 wherein the basic nitrogen containing compound is reacted with the molybdenum compound to form a molybdenum containing intermediate, and the molybdenum containing intermediate is reacted with carbon disulfide to form the molybdenum and sulfur containing composition.

3. The composition of claim 1 wherein the basic nitrogen containing compound is reacted with the carbon disulfide to form a sulfur containing intermediate, and then the sulfur containing intermediate is reacted with the molybdenum compound to form the molybdenum and sulfur containing composition.

20 4. The composition of claim 1 wherein the basic nitrogen containing compound is the product made by reacting a carboxylic acid or reactive equivalent thereof with an alkylene polyamine.

5. The composition of claim 1 wherein the basic nitrogen containing compound is a hydrocarbyl amine.

25 6. The composition of claim 1 wherein the basic nitrogen containing compound comprises a mixture of a hydrocarbyl amine and the product made by reacting a carboxylic acid or reactive equivalent thereof with an alkylene polyamine.

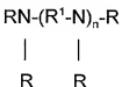
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7. The composition of claim 4 wherein the carboxylic acid or reactive equivalent thereof has about 8 to about 34 carbon atoms per molecule.

5 8. The composition of claim 4 wherein the carboxylic acid or reactive equivalent thereof is a fatty acid.

9. The composition of claim 4 wherein the carboxylic acid or reactive equivalent thereof is hydrocarbon substituted carboxylic or reactive equivalent thereof made by reacting one or more alpha, beta olefinically unsaturated carboxylic acid reagents containing 2 to about 20 carbon atoms, exclusive of the carboxyl groups, with one or more olefin polymers.

10. The composition of claim 4 wherein the alkylene polyamine is a compound represented by the formula



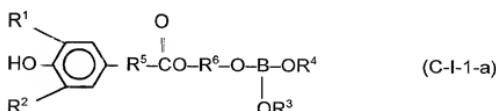
20 wherein n is from 1 to about 14; each R is independently a hydrogen atom, a hydrocarbyl group or a hydroxy-substituted or amine-substituted hydrocarbyl group having up to about 30 atoms, or two R groups on different nitrogen atoms are joined together to form a R<sup>1</sup> group, with the proviso that at least one R group is a hydrogen atom, and R<sup>1</sup> is an alkylene group of about 1 to about 10 carbon atoms.

25 11. The composition of claim 4 wherein the carboxylic acid or reactive equivalent thereof is isostearic acid and the alkylene polyamine comprises alkylene polyamine bottoms.

12. The composition of claim 6 wherein the hydrocarbyl amine is oleyl amine and the product made by reacting a carboxylic acid or reactive equivalent thereof with an alkylene polyamine is a polyisobutene substituted succinimide.

5 13. The composition of claim 1 wherein the molybdenum compound is  $\text{MoO}_3$ .

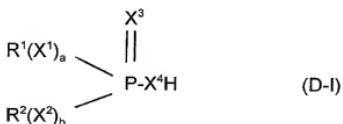
10 14. The composition of claim 1 wherein the boron containing compound is a borated ester represented by the formula



wherein in formula (C-I-2-a), each R is independently hydrogen or a hydrocarbon group.

16. The composition of claim 1 wherein the boron-containing compound is tri-n-butyl borate.

17. The composition of claim 1 wherein the phosphorus containing compound is a metal salt of a compound represented by the formula



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wherein in formula (D-I): X<sup>1</sup>, X<sup>2</sup>, X<sup>3</sup> and X<sup>4</sup> are independently oxygen or sulfur, a and b are independently zero or one, and R<sup>1</sup> and R<sup>2</sup> are independently hydrocarbyl groups.

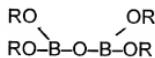
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18. The lubricating oil composition of claim 1 wherein the lubricating oil composition further comprises a detergent, dispersant, corrosion-inhibiting agent, oxidation-inhibiting agent, viscosity index modifier, dispersant viscosity index modifier, pour point depressing agent, extreme pressure agent, antiwear agent, friction modifier, anti-foam agent, or mixture of two or more thereof.

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19. A lubricating oil composition, comprising:  
(A) a base oil;

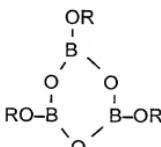
(B) a molybdenum and sulfur containing composition derived from: the product made by reacting a fatty acid with an alkylene polyamine;  $\text{MoO}_3$ ; and carbon disulfide;

(C) a borated ester represented by one or more of the formulae

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or



(C-I-1)

(C-I-2)

(C-I-3)

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wherein in formulae (C-I-1), (C-I-2) and (C-I-3), each R is independently a hydrocarbon group and any two adjacent R groups may together form a cyclic group; and

(D) optionally a zinc dialkyl dithiophosphate, provided the phosphorus content of the lubricating oil composition does not exceed about 0.10% by weight.

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20. A lubricating oil composition, comprising:

(A) a base oil;

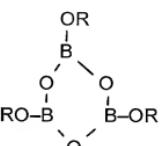
(B) a molybdenum and sulfur containing composition derived from: a polyisobutene substituted succinimide; oleyl amine;  $\text{MoO}_3$ ; and carbon disulfide;

(C) a borated ester represented by one or more of the formulae

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or



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(C-I-1)

(C-I-2)

(C-I-3)

wherein in formulae (C-I-1), (C-I-2) and (C-I-3), each R is independently a hydrocarbon group and any two adjacent R groups may together form a cyclic group; and

5 (D) optionally a zinc dialkyl dithiophosphate, provided the phosphorus content of the lubricating oil composition does not exceed about 0.10% by weight.

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